

1 WHAT IS CLAIMED IS:

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3 1. An integrated hydroconversion process for the treatment of
4 Fischer-Tropsch products including a first hydrocarbon stream
5 comprising a wax and a second hydrocarbon stream comprising a
6 condensate, the process having at least two stages, a hydrocracking
7 stage and a hydrotreating stage, each stage possessing at least one
8 reaction zone, wherein the process comprises the following steps:

9

10 (a) combining a first hydrocarbon stream with a first hydrogen-rich
11 gaseous stream to form a first feedstock;

12

13 (b) passing the first feedstock of step (a) to a hydrocracking reaction
14 zone, which is maintained at hydrocracking conditions, to form a
15 hydrocracking zone effluent comprising normally liquid phase
16 components and normally gaseous phase components;

17

18 (c) passing the hydrocracking zone effluent of step (b) to a heat
19 exchanger or series of exchangers, where it is cooled;

20

21 (d) separating the components of the cooled effluent of step (c) into a
22 vapor stream and a liquid stream;

23

24 (e) combining the vapor stream of step (d) with the second
25 hydrocarbon stream to form a second feedstock, the liquid stream
26 of step (d) being passed to lubricant production or to further
27 processing for manufacture of fuel and diesel products;

28

29 (f) passing the second feedstock of step (e) to a hydrotreating zone,
30 which is maintained at conditions sufficient for reducing the content

- 1 of sulfur, nitrogen, oxygenates and unsaturates present in the
2 second hydrocarbon stream, to form a hydrotreating zone effluent;
3
- 4 (g) separating the hydrotreating zone effluent of step (f) into a liquid
5 stream comprising products and a second hydrogen-rich gaseous
6 stream;
7
- 8 (h) passing the liquid stream of step (g) to further processing, and
9 passing the hydrogen-rich gaseous stream of step (g) to further
10 separation into a light hydrogen-rich gaseous stream, and a
11 stream comprising liquid products; and
12
- 13 (i) recycling at least a portion of the hydrogen-rich gaseous stream of
14 step (h) to the hydrocracking zone and hydrotreating zones.
- 15 2. The process of claim 1, wherein the liquid stream comprising products of
16 step (h) is passed to further separation into a liquid products stream as
17 well as light gaseous components which are sent to fuel gas.
18
- 19 3. The process of claim 1, wherein the liquid products stream of claim 2 is
20 sent to fractionation and separated into product streams comprising gas
21 or naphtha stream which are removed overhead, one or more middle
22 distillate streams, and a bottoms stream suitable for further processing.
23
- 24 4. The process according to claim 1, wherein further processing for
25 manufacture of fuel and diesel products of the liquid stream of step (d)
26 further comprises:
27
- 28 (a) combining the liquid stream of claim 1, step (d), with the liquid
29 fraction of claim 1, step (g), to form a single stream;
30

- 1 (b) separating the single stream of step 4(a) into a light stream and a
2 heavy stream, the heavy stream being sent to fractionation;
3
- 4 (c) combining the light stream of step 4(b) with the products stream of
5 claim 1, step (h), to form a single stream; and
6
- 7 (d) separating the single stream of step 4(c) into a light gaseous
8 stream and a liquid products stream, the light gaseous stream
9 proceeding to fuel gas and the liquid products stream proceeding
10 to fractionation.
11
- 12 5. The process according to claim 1, wherein the hydrocracking zone of
13 step 1(b) is maintained at conditions sufficient to effect a boiling range
14 conversion of the first hydrocarbon stream of at least about 25%.
15
- 16 6. The process according to claim 5, wherein the hydrocracking zone of
17 step 1(b) is maintained at conditions sufficient to effect a boiling range
18 conversion of the first hydrocarbon stream of between 30% and 90%.
19
- 20 7. The process according to claim 1, wherein the waxy first hydrocarbon
21 stream of claim 1 has a normal boiling point greater than about 600°F.
22
- 23 8. The process according to claim 1, wherein the second hydrocarbon
24 stream of claim 1 has a normal boiling point below 700°F.
25
- 26 9. The process according to claim 8, wherein the second hydrocarbon
27 stream boils in the range C₅-650°F.
28
- 29 10. The process according to claim 1, wherein the reaction zone of step 1(b)
30 stage is maintained at hydrocracking reaction conditions, including a
31 reaction temperature in the range from about 340°C to about 455°C

1 (644°F-851°F), a reaction pressure in the range of about 3.5-24.2 MPa
2 (500-3500 pounds per square inch), a feed rate (vol oil/vol cat h) from
3 about 0.1 to about 10 hr⁻¹ and a hydrogen circulation rate ranging from
4 about 350 std liters H₂/kg oil to 1780 std liters H₂/kg oil (2,310-11,750
5 standard cubic feet per barrel).
6
7 11. The process according to claim 1, wherein the reaction zone of step 1(g)
8 is maintained at hydrotreating reaction conditions, including a reaction
9 temperature in the range of from about 150°C to about 500°C
10 (302°F-932°F), a reaction pressure in the range of from about 2.1 MPa
11 to 24.2 MPa (300-3,500 psi), a feed rate (vol oil/vol cat hr⁻¹) from about
12 0.1 to about 20 hr⁻¹, and a hydrogen circulation rate in the range from
13 about 350 std liters H₂/kg oil to 1780 std liters H₂/kg oil (2,310-11,750
14 standard cubic feet per barrel).